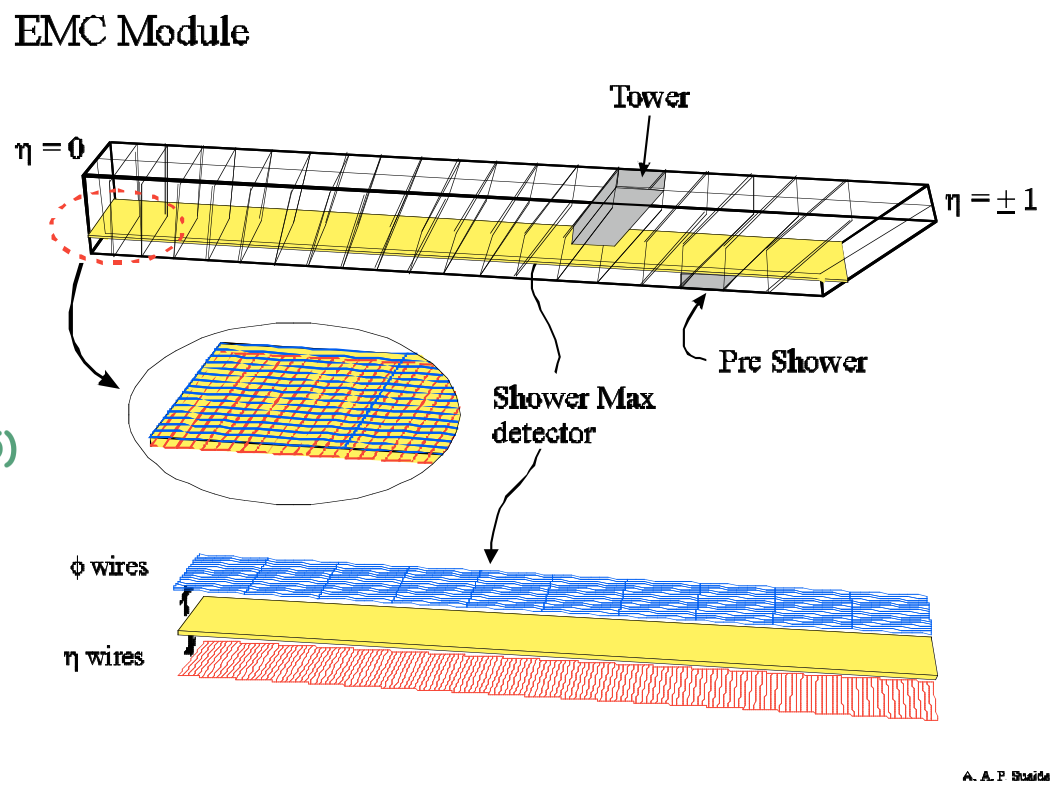
EMC Commissioning for the 2002-2003 run

- EMC detector
- Review of last year run
  - Installed system
  - What worked and what didn't work
- EMC for the next run
  - Installed system
  - System modifications
  - Commissioning plan

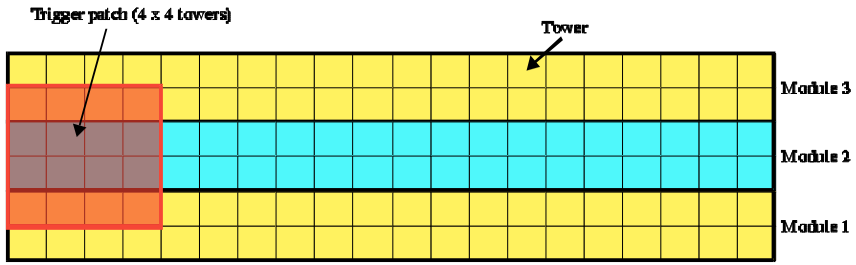
EMC detector overview

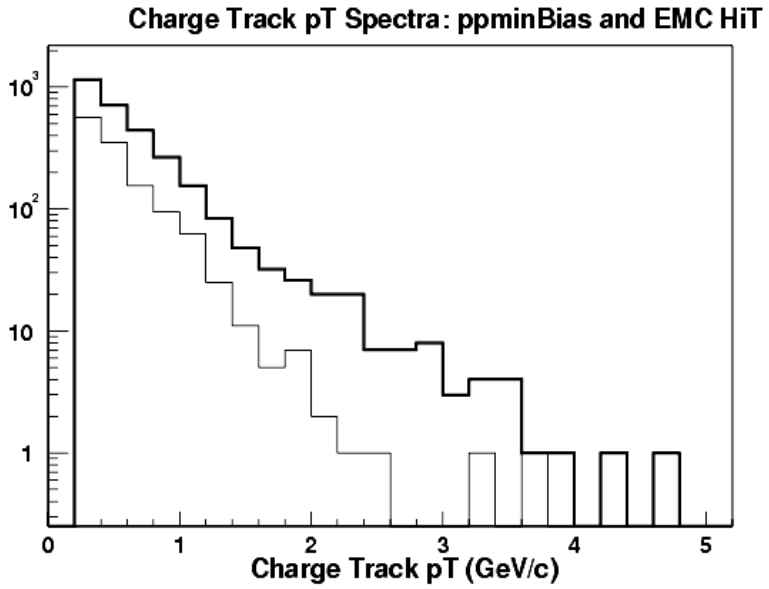
- Full barrel EMC
  - -1.0 < □ < 1.0
  - Full azimutal coverage
  - 120 modules
    - $(\square\square, \square\square)_{module}$ ~ (1.0, 0.1)
    - 40 towers/module
      - 21 X_0
      - $(\square\square, \square\square)_{tower}$ ~ (0.05, 0.05)
      - dE/E ~ 14%/√E
    - Shower max detector
      - Positioned at ~ 5 X_0
      - Larger spatial resolution
      - (□□, □□) ~ (0.007, 0.007)
    - Pre-shower detector
      - 2 X_0



EMC trigger overview

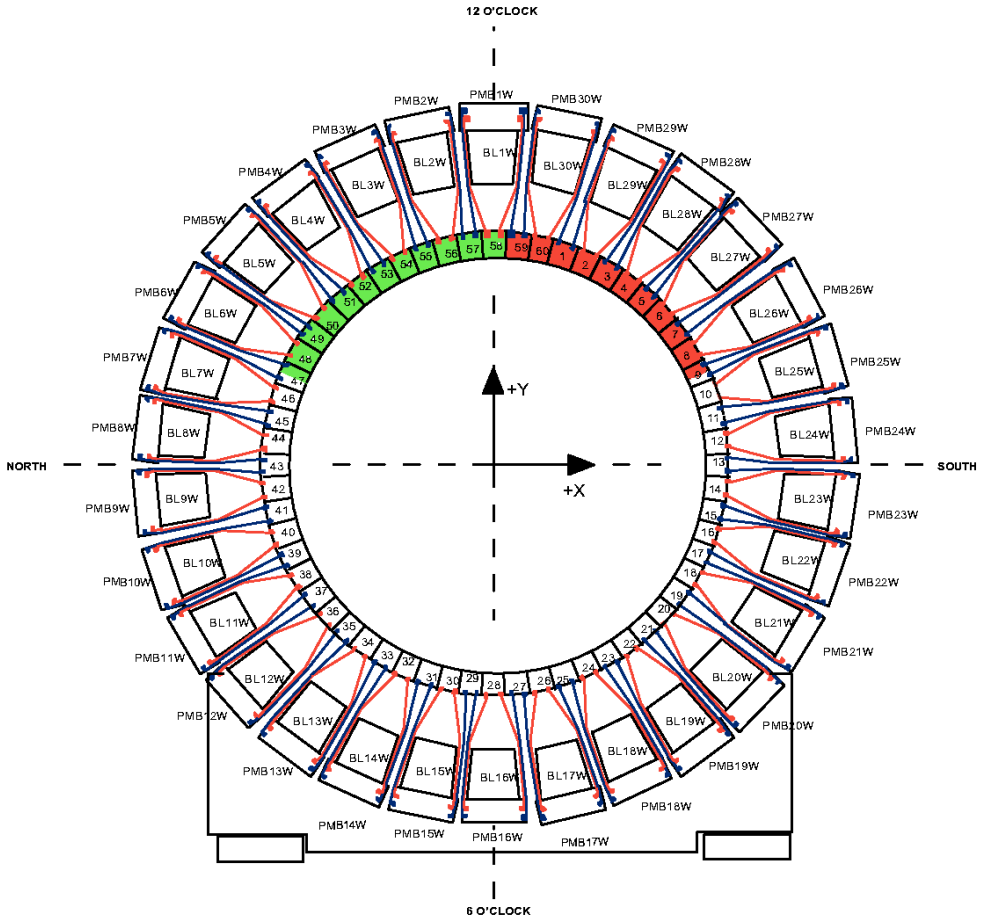
- Photons, electrons, π^0, jets, E_t
  - Trigger patches
    - 4 x 4 towers
    - ($\Delta\eta$, $\Delta\phi$) ~ (0.2, 0.2)
    - Highest tower in patch (HT)
      - 0.5 GeV energy resolution
    - Patch sum
      - Look up table
  - Jet trigger
    - Sum over patches for 8 modules
  - E_t trigger
    - Total Energy on EMC (centrality trigger)





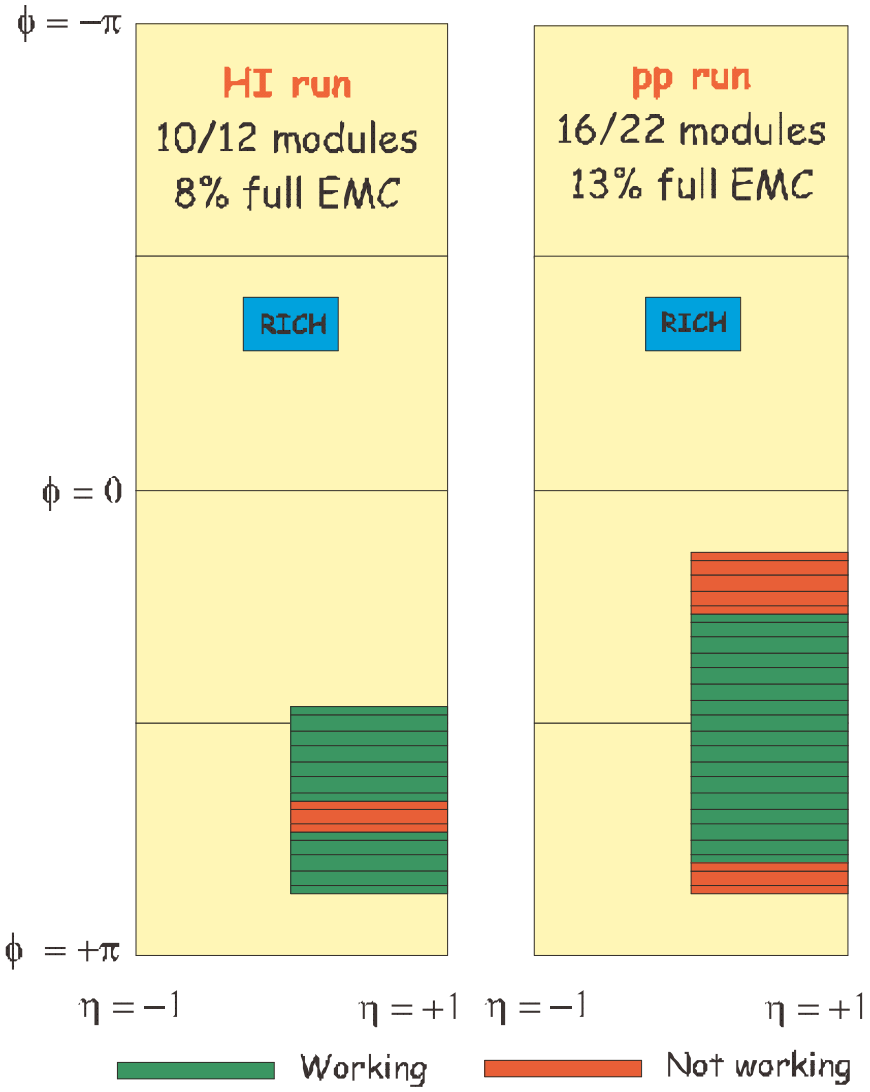
Review of last year run – Installed patch …

- Heavy-ion run
  - 12 modules instrumented
  - 480 towers
    - (□□, □□) ~ (1.0, 1.2)
    - Running since late august
  - No SMD most of time
    - Last week of HI only
- pp run
  - 22 modules instrumented
  - 880 towers
    - (□□, □□) ~ (1.0, 2.2)
  - SMD
  - High-tower trigger



… and what worked

- Not 100% of instrumented patch took data
  - Digitizer crates problems
    - A few High Towers were turned off
    - Noise on some high towers
    - 12 bits ADC -> 6 bits Trigger ADC problems
  - PMT Boxes problems
    - HV interlock problem on PMT 4 during HI run
    - HV stability problem during pp run
- Heavy-ion run
  - 10/12 modules working
- pp run
  - 16/22 modules working
  - High tower trigger



What were the problems? High voltage system

- Original system didn't work
  - One serial line for 60 modules
    - Daisy chained through a special board in the digitizer crate
    - Strong noises and fluctuations on serial line
- Temporary fix (not perfect but usable)
  - One serial line for each 3 PMT boxes (6 modules)
    - Dirty connections
    - Some noise on serial line
      - Reduced speed on data transfer
      - Sometimes we lost communication with PMT boxes
    - High voltage instability on some PMT boxes
      - High voltage turns off after a few minutes for some boxes (box problem?)

What were the problems? Tower crates

- Digitizer electronics
  - Connection between crate and Tower Data Collector (TDC) sometimes is lost
    - Data is garbage
    - Need to power cycle and reprogram everything
- Trigger electronics
  - 6 bits ADC conversion didn't work for some patches
  - Trigger mask didn't work for some patches
  - Trigger programming instability
    - Need to power cycle and reprogram crate
- Crates failure
  - Two power supply failures
    - Replaced after a few days

What were the problems? SMD

- SMD Crate
  - Was hanging up DAQ
    - Fixed after the crate was reprogrammed
  - HDLC line
    - Not possible to daisy chain SMD crate (under investigation)
  - One power supply failure
    - Fixed after the crate was sent to LBNL for repair
- SMD FEEs
  - Some didn't work well
    - No signal, high noise
    - Were replaced but some modules didn't work because of the lack of spares
  - Thermo switch interlock sensitive to the magnetic field
    - Just noticed on one FEE board (kept off)
- High Voltage problem with some modules
  - Could not turn HV on

What were the problems? DAQ and trigger

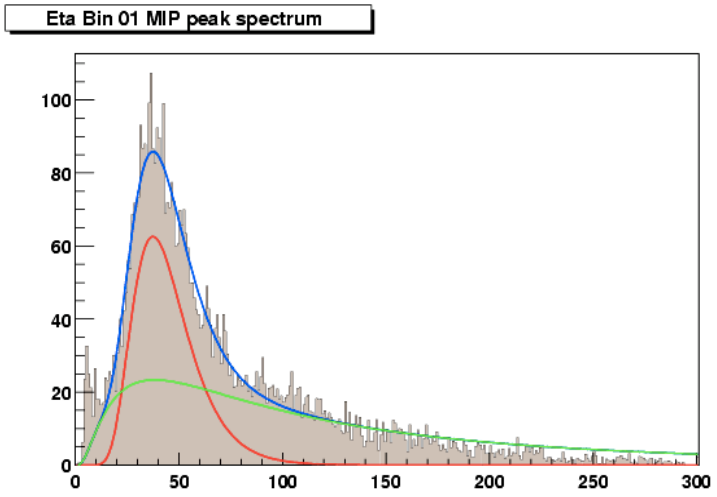
- DAQ
  - Stop/busy/halt (you name it) problem for TDC
    - Didn't work
  - problems with high event rates
  - SMD busy didn't work most of the run
  - Always needed a slower detector to provide busy
- Trigger
  - EMC signal was arriving too late
    - Fixed after modifications that removed one layer of DSM's (not final solution)
  - Trigger stability (fixed by the end of pp run)

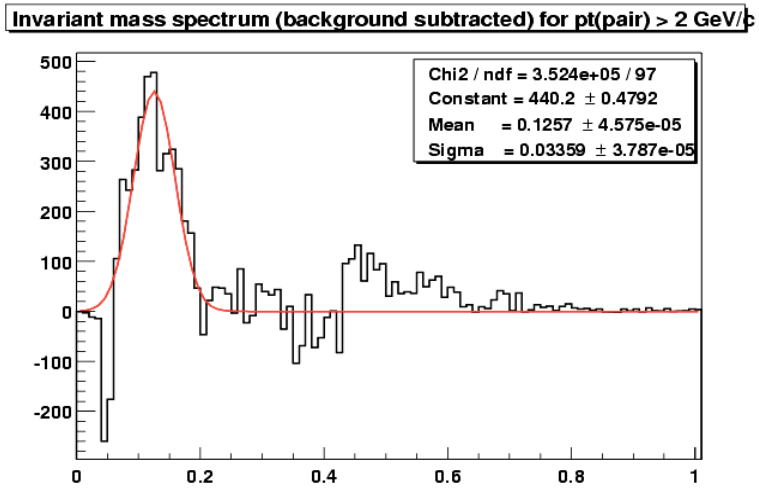
What were the problems? Need for experts

- System was too complicated to run
  - Tower electronics
    - Many clicks (30-50) to bring the system up
    - No good tools for debugging/monitoring
  - SMD electronics
    - Many clicks to bring the system up
    - No good tools for debugging/monitoring
  - High voltage system
    - SC program is very easy to use but HV instability required an expert for operation

But the run wasn't that bad at all…

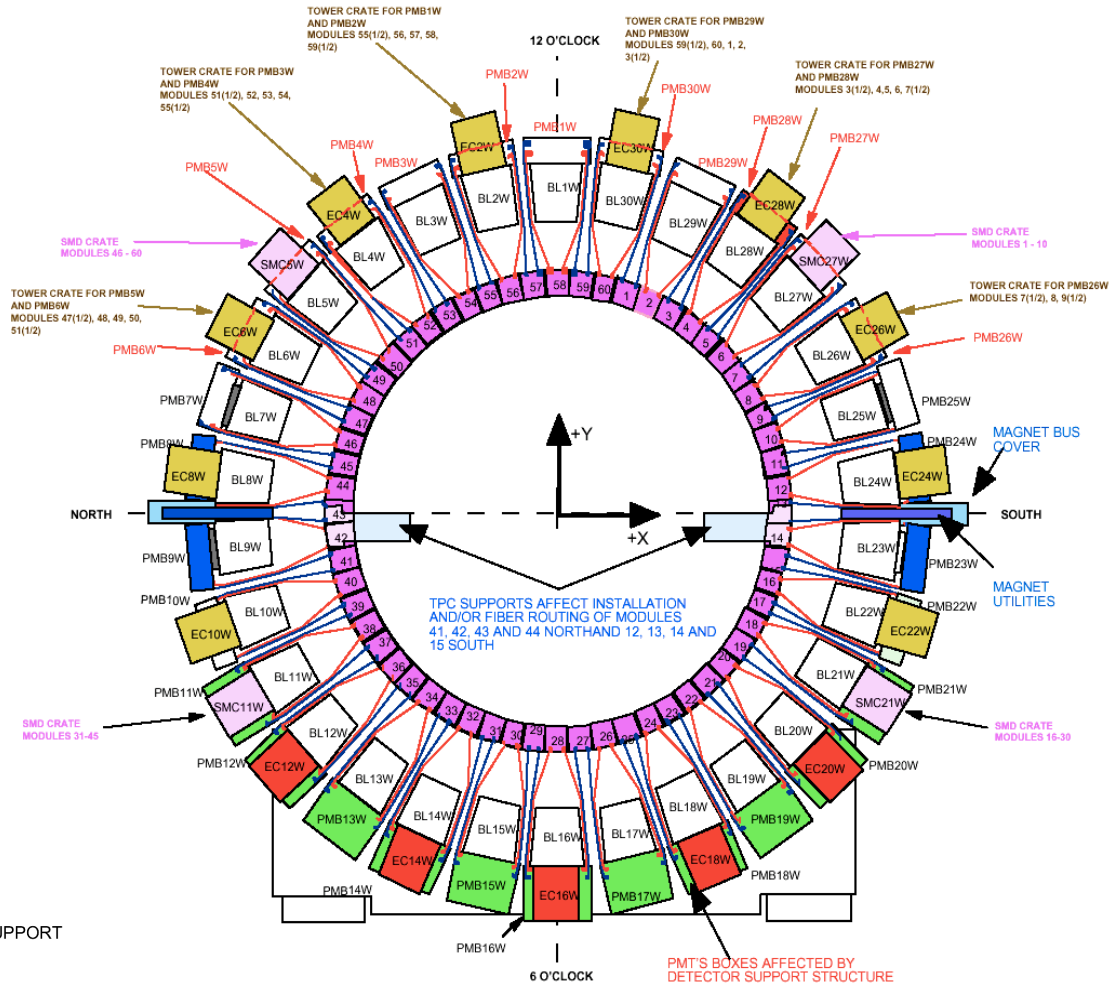
- EMC took data
  - Almost half of minimum bias data for towers
  - Almost all central data
  - Almost half of pp minimum bias data
  - About 800 k high tower triggers
- EMC gain stability
  - ~ 5% gain variation over 3 weeks
- Analysis is going on… data is good.





EMC for the next run. Installed system

- Full West side installed
  - 36 more modules
  - 60 tower modules
  - 60 SMD modules
  - EMC L0 trigger
- Huge impact on physics
  - High-p_t π^0
  - Jets
  - J/ψ ?



EMC FACE OF THE STAR BARREL AS SEEN FROM +Z (WEST FACE) SHOWING THE CONFIGURATION OF MODULES, PMT'S BOXES AND ELECTRONICS CRATES.

SPECIAL DESIGN PMT'S BOXES

INSTALLED MODULES

ELECTRONICS CRATES AFFECTED BY THE DETECTOR SUPPORT STRUCTURE, POSITION HAS TO BE REASSIGNED.

BOXES THAT REQUIRE SOME MODIFICATION

MODULES INSTRUMENTED

Installation schedule

- Modules
  - Full West side
    - Including modules under TPC support
  - Installation done by 9/5
- PMT boxes
  - Install 18 new PMT boxes
  - Remove and modify 6 old PMT boxes
  - Install fibers and utilities
  - Installation done by 10/15
- Electronics (?)

Commissioning plan. High voltage

- New serial communication
  - Serial line splitters
    - One serial line for 60 modules
    - Faster communication
    - Low noise
    - ALREADY TESTED last month in BNL
  - Stability using LED trigger
- Almost the same control program
  - One button (on/off)
  - Small internal modifications
- Need to have digitizer crates installed to test full system (crate provides power to PMTB)
- HV will be set to ADC uniformity in E_t, not E
  - Will provide trigger on E_t instead of E
  - Different settings for AuAu and pp to have different gains (working groups should define the dinamic range)

Commissioning plan. Tower digitizer crates

- Better QA will be done prior to installation
  - Now that we know what to expect from crates
- Programming and timing stability
  - Can be done using cosmic rays trigger using CTB and LED trigger
  - New tools to monitor crate
- New SC software
  - Easier to use (one on/off button)
  - Will be tested soon
- DAQ
  - Busy/halt/stop
  - Pedestal subtraction
  - BAD TDC events

Commissioning plan. SMD

- HDLC line problem is being checked at LBNL
- Will have more time to test FEEs
- Calibration pulse will be available
  - Find bad channels
  - Strip gain uniformity
- New SC program
  - Easier to use.
  - Same as towers'
- DAQ
  - Will test busy better
  - Pedestal subtraction

Commissioning plan. Trigger

- Trigger electronics will have different QA before installation
  - Will check 6 bits conversion and trigger masks for each digitizer board
  - ADC 63 problem is being debugged
- Trigger stability
  - Tested using EMC to trigger cosmic rays, checking rates for different thresholds

Commissioning plan. Online QA, calibrations, etc

- New event display
  - Will include trigger data
- Online histograms
  - Different histograms now that we know better what to look
- Calibration
  - Pre calibration using L3 tracks
    - Will be done online (not a L3 algorithm) using L3 tracks and events from event pool
    - Will need less events (higher coverage)

Detectors experts during commissioning (?)

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- O. Grachov
- V. Petrov
- B. Minor
- V. Ghazikhanian
- A. Vander Molen